REMARKS/ARGUMENTS

This is in response to the Office Action dated May 28, 2010. Claims 2-11 and 13-23 are pending and stand rejected in the outstanding Office Action. Claims 20 and 22 have been amended.

The rejection of independent claims 20 and 22 under 35 U.S.C. §103(a), as allegedly being unpatentable over Elliot et al. (US 7,020,504), in view of Billhartz (US 2003/0204587), Light (US 2003/0236866) and Baran et al. (US 5,115,433), is respectfully traversed.

Amended claim 20 (similarly for claim 22) recites "...generating a scalar status value in each said mobile data relay device*, the value being indicative of the relative status of that device,... if said evaluation determines that the status value of an identified one of the other devices and the status value of the mobile data relay device differ in a manner and direction that satisfies a predetermined condition*, then transmitting at least part of its accumulated sensor data...". Support for the amendment can be found, foe example, in p. 7, lines 25-32 of the instant specification. None of Elliot/Billhartz/Light/Baran teaches or suggests this feature.

In the invention of claims 20 and 22, a status value is derived for each device, based on parameters including the amount of data waiting to be transmitted and the distance from other such devices.

Information relating to such status values is exchanged with neighboring devices. On the basis of the status values of a particular device and its neighbors, the particular device then makes a decision as to whether to transmit the data it holds to such other devices. In other words, the devices themselves have status values, and comparison of these status values can be used to determine in which direction data should pass between them on its way to its ultimate destination (the data collection point or "sink").

For example, the instant specification recites (p. 7, line 7 to p. 8, line 2):

> In the described embodiment the central collecting devices (sinks) assign their status value to be zero. The more capable any other device is of receiving data (due to proximity to other such devices, long battery life, or low buffer content) the lower the status value it will grant itself. Similarly, a full buffer, or low battery life, will raise the status value of a device. By requiring that each device can only select other devices having lower status values, data can be quickly forwarded to the sinks (held at status value zero), while maintaining as even a load on the individual sensors in the network as possible due to the nature of the determination of status value. For example, if a device is doing more work than the rest of the network, for example by virtue of its location near to a destination device, then its battery level will decrease more quickly, leading to an increased relative status value, thereby inhibiting other sensors from continuing to forward data to it. In this way, the network is exceptionally good at distributing the load across multiple routes where they exist.

According to the above, the status value that is computed for each mobile data sensor/mobile data relay device establishes a hierarchy in the devices, resulting in a hierarchical routing in the ad-hoc network of the mobile devices. More specifically, each device can only select other devices to send its data, if said other devices have lower status values. For example, if a device has lower battery level, then it will have increased relative status value, which will inhibit other devices from sending data to it.

Based on the Examiner's helpful suggestion (see bottom paragraph of p. 3 of the Office Action), Applicant has amended claims 20 and 22 to recite "if said evaluation determines that the status value of an identified one of the other devices and the status value of the mobile data relay device differ in a manner and <u>direction</u> that satisfies a predetermined condition, then transmitting at least part of its accumulated sensor data...", emphasis added, so that the hierarchical nature of the routing (determining the direction data should flow) is implied in the claim language.

The idea of a hierarchy is implicit in the term "status" used in the claims, when interpreted in light of the description which refers to one node having a "higher" or "lower" status than another (see page 7 of the instant specification). The overall structure of the hierarchy is not something of which the individual nodes are aware - each one simply compares its own status value relative to those of their neighbors, and transmits or receives data according to these relative values. This is one key as to to how the invention of claims 20 and 22 works - a device does not need knowledge of the entire network: only its status relative to its close neighbors is required in order to identify a neighbor to which it should forward the data it holds.

None of the cited prior art references teaches this "hierarchy" in the sending of data flow.

Elliot discloses a system of sensor nodes in which data travels from one sensor to another through an ad hoc network. Column 4 describes the organization of this

network, but is silent as to how it is established. It seems that the nodes are allocated to "tiers". These "tiers" can not be considered directly analogous to the status values of claims 20 and 22, as they are not determined in the same way. From columns 7 and 8 of Elliot, it appears that when a device becomes active, it selects another (already-active) device as a "parent", and thus will be established in the tier below that of the parent.

Thus, the only determinant of the tiers to which two neighboring devices are allocated and, therefore, in which direction data will pass, is by which device has been active longer. In the invention of claims 20 and 22, the factors determining which devices should transmit data to which others (i.e., the direction of data flow) depend on dynamic factors such as the amount of data currently in the buffer, which will vary with time depending on whether the devices are collecting data (either from the environment or from each other) faster or slower than they are passing it on to further devices.

Billhartz is not concerned with data collection, but with applications in which two-way communication is required between any given pair of nodes in the network. The problem addressed is, therefore, rather different. In particular, the question of the direction of data flow is not pertinent – in Billhartz' system, information must be able to flow in both directions, and there is no ultimate destination ("sink") to which all data is to go. Paragraph [0049] mentions unilateral communication, but it is apparent that the process is the same as for bilateral communication.

Paragraph [0053] in Billhartz discusses the measurement of quality of service (QoS) values both for links between nodes, and of the nodes themselves. However, as seen from paragraph [0051], the various QoS measures do not result in a status value, but in a connection confirmation or denial (CONFQ or RERRQ) in response to a connection request RREQQ. Note, in particular, that this is a binary value (yes/no) and applies equally to communication in <u>either</u> direction.

The invention of claims 20 and 22 only specifies how a first device determines whether it can transmit data to a second device – it does not specify whether the first device can receive data from the second device. However, in general, if data can not be transmitted in one direction, it can be transmitted in the converse direction. This is not the case in Billhartz, where <u>two-way</u> communication is established (or not).

Turning to Light, the Examiner cited paragraphs [0014] and [0016]. However, this reference describes a self-organizing system which simply determines the positions of each device by determining the distances between them and using, for example, triangulation (paragraph [0017]) to determine their positions. There is no suggestion of each device having a scalar value associated with it - only its position – and no hierarchy from which to determine the <u>direction</u> in data should flow between two of the devices.

As discussed above, claims 20 and 22 have been amended to recite a direction of flow between devices, which is not taught or suggested in Light.

Moreover, the Examiner equated the UWB signals discussed in paragraphs 0014 - 0019 of Light with the claimed scalar status value, see p. 3 of the Office Action. However, in Light, the UWB signals contain information which is used to calculate distance, they are not themselves a distance value. Looking at the description of these UWB signals in paragraph 0013 of Light, it is apparent that the signals are merely timed pulses. They contain no inherent information about the device transmitting them, and certainly not its distance from other devices. Only by measuring, at a receiver, the time of arrival of a particular pulse, can the separation of the transmitter and receiver be determined. Significantly, as the situation is <u>symmetrical</u> (transceivers A and B should each determine the same value for the distance between them), the values determined by Light <u>cannot determine the relative status (positions in a **hierarchy**) of two neighboring devices</u>.

Moreover, claims 20 and 22 require each device to have its own scalar status value, which is compared with those for other devices. It is apparent that Light's specification does not require each device to generate its own status value: it determines a (scalar) distance value for each other device it can detect, but that value is not something the other device will assign to itself - it will be merely one of several different values assigned to it by its various neighbors.

Baran is not an ad hoc network. The nodes each have a unique geographical identifier (see col. 3, lines 48-64). Each node uses knowledge of link quality to

determine to which other nodes it should transmit packets. A hierarchy is mentioned (col. 4, line 21), but it is apparent that this is not an absolute measure – it is an order of preference, specific to one node, of the links to neighboring nodes. In particular, it should be noted that each node will establish a different hierarchy for its links to neighbors, depending on, among other things, its distance from those neighbors (see column 8). The nodes themselves have no status associated with them – the hierarchy relates to the links between nodes.

In the invention of claims 20 and 22, the devices themselves have status values, and comparison of these status values can be used to determine in which direction data should pass between them on its way to its ultimate destination (the data collection point or "sink"). This feature is not taught or suggested by any of the cited prior art references.

None of Ivan (NPL document "Power-Aware Localized Routing in Wireless Networks") or Krishnamurthy (US 6,735,448) cures the deficiencies of Elliot/Billhartz/Light/Baran.

For at least the above reasons, claims 20 and 22 are allowable.

It is respectfully requested that the rejection of claims 2-11, 13-19, 21 and 23, each being dependent from claim 20 or 22, also be withdrawn.

In view of the foregoing and other considerations, all claims are deemed in condition for allowance. A formal indication of allowability is earnestly solicited.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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